From Flat to Immersive: Redefining the Virtual Try-on Experience for Press on Nails

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Abstract: *This study presents an innovative immersive virtual try-on solution for press-on nails, using Vision Pro as the platform. It redefines the traditional virtual try-on experience, which primarily relies on 2D texture mapping, by offering a more immersive approach. User testing of the demo revealed that this immersive system significantly outperforms existing applications (such as Nailio) in terms of immersion, presence, realism, and decision-making confidence. The system also excels in interaction fluidity, greatly enhancing the overall virtual try-on experience for press-on nails. This research provides valuable insights for improving user experience in the press-on nail industry and contributes to the academic exploration of virtual try-on and augmented reality applications.*

Keywords: *Press-on nails, User experience, Augmented reality(AR), Vision Pro*

1. Introduction

Press-on nails, as an emerging alternative to traditional manicures, have gained increasing popularity among consumers due to their convenience, aesthetic appeal, and durability. [1]With a wide variety of designs and ease of use, they have become a favored choice. According to market research by 168report, the global press-on nail market is expected to reach $9 billion by 2027, highlighting the significant consumer demand and growth potential in this sector.[2] In recent years, the demand for press-on nails on online platforms has surged, making it a major shopping channel for this product.[3] As the digital space continues to expand, there is growing interest in providing consumers with an experience comparable to in-store shopping.[8]

To meet the increasing demand for online shopping, numerous press-on nail brands have launched virtual try-on features on platforms such as Nailio, YouCam Nails, and ModiFace. These platforms allow users to upload hand photos or preview press-on nails in real-time using hand videos. Research shows that these augmented reality (AR)-based virtual try-on features can enhance consumers' intuitive understanding of the product, optimizing the shopping decision-making process and reducing return rates.[4][5]

However, not all virtual try-on features deliver the expected results. Hanna Lee et al. highlighted in their research on AR-based virtual fitting rooms that "technical issues such as latency and low-resolution rendering can negatively impact the user experience, leading to frustration and reduced adoption rates." [6]Kwon et al.'s study also showed that the resolution of product models and the smoothness of interaction can affect the perceived realism of virtual try-ons.[7]

Through analyzing current mainstream virtual try-on applications in the press-on nail industry, we found that most brands use 2D texture mapping for product display, failing to fully replicate the true thickness, style, and texture of press-on nails. This limitation exacerbates the emotional challenges faced by virtual try-on features—many consumers distrust the accuracy of virtual products, concerned that they may not accurately reflect the fit or appearance of the product in real life. [9][10]Additionally, existing applications often struggle with hand tracking, typically requiring users to keep their nails unobstructed and move slowly, significantly impacting the try-on experience and consumer confidence.

To address this, this study proposes an innovative immersive virtual try-on solution for press-on nails, aiming to optimize the virtual try-on experience and enhance consumer decision-making confidence. The solution employs 3D modeling rather than traditional 2D textures, providing a more accurate representation of the thickness, style, and texture of press-on nails. Additionally, this study introduces Vision Pro as the platform for the first time and innovatively applies its built-in hand tracking technology to virtual try-ons for press-on nails, creating a more immersive try-on environment and providing a smoother, more natural interaction experience.

User experiments show that the virtual press-on nails under this solution have a 36.9% improvement in perceived texture, a 29.7% increase in realism, and significantly higher immersion and presence, leading to a marked boost in consumer decision-making confidence. The overall virtual try-on experience has been greatly enhanced. This research not only offers valuable insights for upgrading user experience and digital transformation in the press-on nail industry but also provides a new perspective for academic research in immersive experiences and augmented reality applications.

2. Immersive virtual try-on demo design

We developed an immersive virtual try-on demo for press-on nails to showcase the try-on effects and conduct user testing. Apple Vision Pro was chosen as the platform for the application, with Unity used for development and Blender for modeling the press-on nails.

The immersive virtual try-on system proposed in this study replaces traditional 2D texture mapping with 3D models to display the press-on nails. The quality of the models directly impacts the realism of the virtual press-on nails. During the modeling phase, we focused on several key aspects. First, the curvature of the press-on nails varies in both the vertical and horizontal directions, so we referred to standard nail templates to ensure dimensionality and fit. Second, the five nails in the set have fixed proportions and need to be resized according to standard sizes. Lastly, material and rendering processes are crucial as they affect the tactile appearance of the virtual nails. We differentiated materials such as metal, cat-eye, and matte, and ensured high-quality rendering by adjusting the lighting to avoid blurriness caused by low resolution.

In building the virtual try-on function, we primarily used the Hand Visualizer and Poly Spatial plugins, both official plugins for Unity developed for Vision Pro. Compared to other hand tracking plugins based on nail area recognition, Hand Visualizer offers more precise hand tracking, enabling smooth, natural movement following. Regardless of how the user positions their hand, the virtual press-on nails always align with the nails, preventing misalignment and angle shifts, closely simulating the actual wearing effect. The Poly Spatial plugin mainly adapts the development environment to the Vision Pro device, ensuring a seamless immersive experience.

Through the demo design, we initially implemented the immersive virtual try-on solution, providing a foundation for subsequent user testing.

3. User Testing

To validate the positive impact of the immersive virtual try-on system on consumer experience, we conducted user testing through comparative experiments and surveys. The survey utilized a Likert scale to quantitatively evaluate the immersive virtual try-on system and the traditional press-on nail virtual try-on system across five dimensions: immersion, presence, interaction fluidity, realism, and decision-making confidence. Regression analysis was then performed on the collected data for further analysis.

3.1. Participants

A total of 30 participants were invited for the study, with 28 females and 2 males, mostly between the ages of 22 and 25, along with one participant in their 40s who was a teacher. All participants were familiar with press-on nails and had experience with online purchases and virtual try-on systems. Participants were randomly divided into two groups, A and B, with 15 participants in each group.

3.2. Experimental Process

This study employed a comparative experimental design to assess whether the new press-on nail virtual try-on system significantly enhances the user experience. The experimental group used the immersive virtual try-on system proposed in this study, while the control group used the Nailio virtual try-on application. To eliminate external interference, the experiment was conducted in a controlled environment, with participants trying on the same style of press-on nails in both groups.

Before the experiment, all participants were guided by the researchers to wear the Vision Pro headset and undergo a brief period of device adaptation to familiarize themselves with the immersive environment and interaction methods, minimizing the impact of unfamiliarity with the device.

The experiment was conducted in two rounds. In the first round, group A participated in the experimental group's (new virtual try-on system) try-on experience, while group B used the control group's (Nailio application) try-on system. Each round of testing had no set time limit, allowing participants to control their try-on duration based on their preferences to simulate a real shopping experience. After each session, participants immediately completed the corresponding group's survey to rate various experience dimensions. Following the first round, participants took a 5-minute break to recover.

In the second round, group B used the experimental group's virtual try-on system, and group A used the control group's system, with the same time arrangements as in the first round. Afterward, participants again completed the corresponding survey to assess the virtual try-on experience.

After the experiment, the researchers conducted brief interviews to gather subjective feedback and suggestions for improvement on the new virtual try-on system.

3.3. Questionnaire Setting

The questionnaire in this study was based on the Presence Questionnaire (PQ) and Immersion Tendency Questionnaire (ITQ) models developed by Witmer and Singer (1998) [11], with appropriate modifications to suit the virtual try-on context for press-on nails. The core dimensions of the original questionnaires, especially presence and immersion, were retained. Some scales and items were modified, such as removing scales for auditory experience, interface quality, and game mechanics, and adding a scale for interaction fluidity. Additionally, the focus was integrated into the immersion scale, while the resolution and naturalness scales were merged into a "realism" scale, with items rephrased to assess whether the virtual press-on nails were clear enough and the image/model resolution was sufficiently high.

4. Data Analysis

We analyzed the score distributions of the two virtual try-on systems from the surveys (as shown in figure1 and figure2). It was evident that the immersive virtual try-on system received significantly higher overall satisfaction than the Nailio virtual try-on application. We further calculated the average scores for each item of the two systems (as shown in the figure3), and the results indicated that, except for the item "Q4: I can intuitively understand how to operate the virtual try-on system, and the steps are simple and clear," where both systems scored similarly, the immersive system scored higher on all other items.

To further assess the differences in user experience between the two virtual try-on systems, we conducted a paired sample t-test on the data. The mean difference in scores was 0.875, with a t-value of 6.048. This indicates that the immersive virtual try-on system significantly enhances the press-on nails virtual try-on experience.
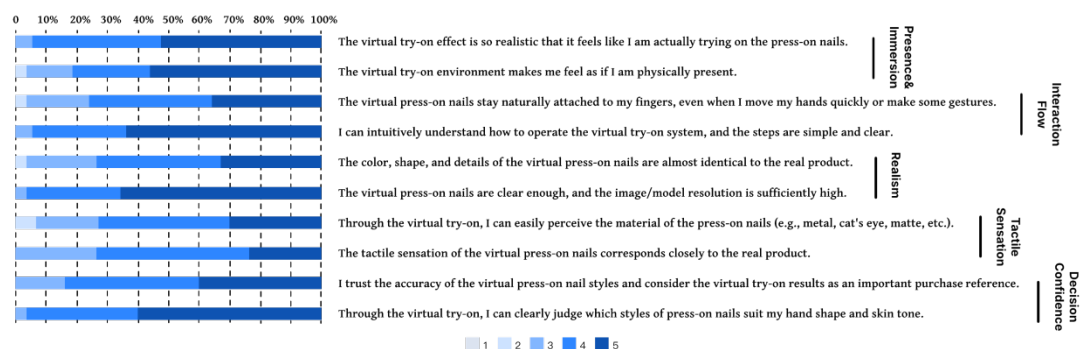

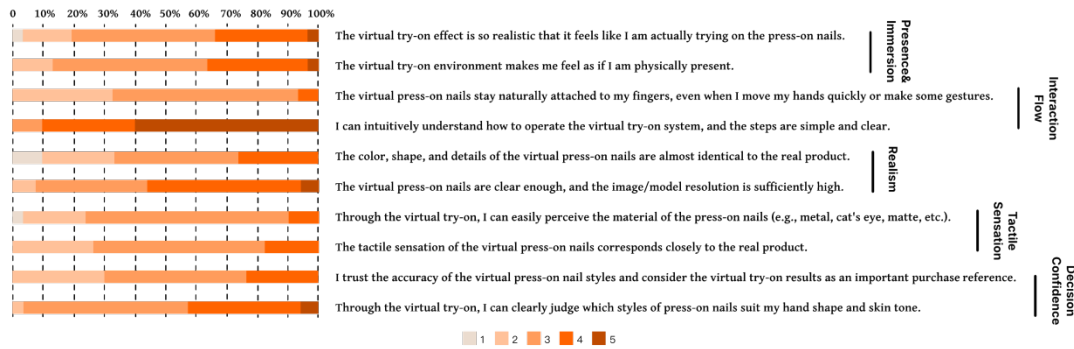*Figure 1: The evaluation distribution of the immersive press-on nails virtual try-on system (Demo).*

Figure 2: The evaluation distribution of the traditional press-on nails virtual try-on system (e.g., Nailio).
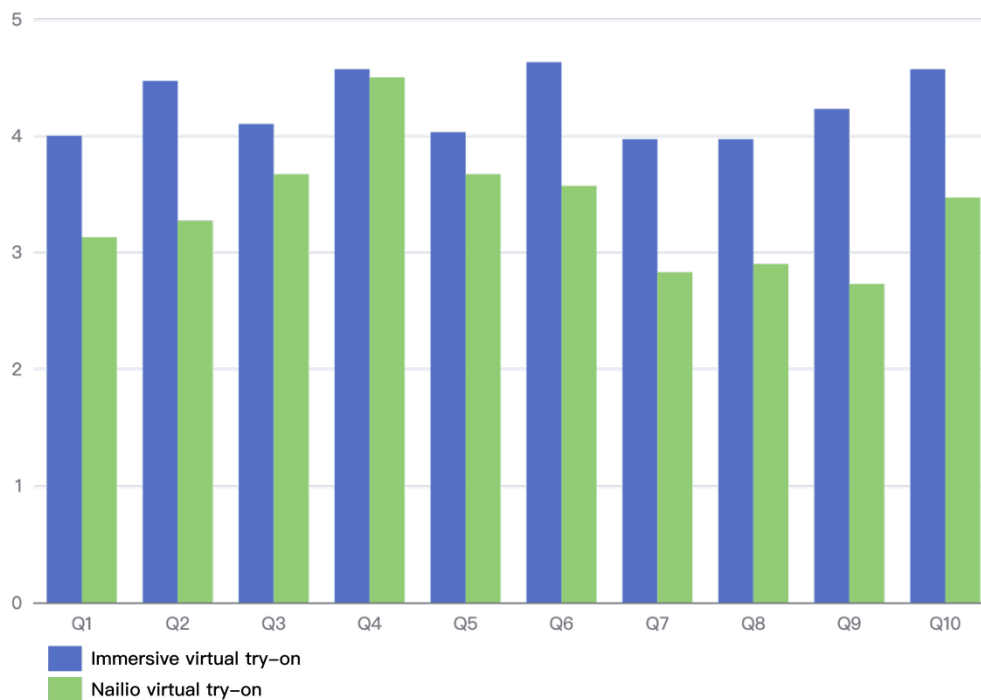

Figure 3: Comparison of the average scores of the immersive press-on nails virtual try-on system (Demo) and the traditional press-on nails virtual try-on system (e.g., Nailio).

5. Conclusions

This study presents an innovative immersive virtual try-on system for press-on nails, using AR glasses as the platform, aimed at improving the virtual try-on experience and enhancing consumer decision-making confidence. By updating the presentation of virtual products and utilizing the hand tracking technology built into Vision Pro, this system successfully optimizes the traditional 2D texture mapping virtual try-on experience, providing users with a more realistic and immersive experience. The experimental results show that, compared to existing press-on nail virtual try-on applications (such as Nailio), the immersive virtual try-on system demonstrates significant advantages in terms of immersion, presence, realism, and decision-making confidence, with high ratings in interaction fluidity as well. Specifically, users reported a notable improvement in the texture and realism of the virtual press-on nails, and there was a significant increase in consumers' willingness to base their purchasing decisions on the virtual try-on results. The overall virtual try-on experience was much more advantageous.

However, this study has certain limitations. Firstly, the sample size is relatively small and primarily focused on young women. Future studies should expand the sample range to include more participants from different age groups and genders in order to further evaluate and optimize the generalizability of

the immersive press-on nail virtual try-on system. Additionally, this research only completed the demo version of the immersive virtual try-on system, with supplementary features and interface design still under development. As a result, the current study mainly focuses on the optimization of the virtual try-on experience through the presentation of virtual products. In the future, once the full virtual try-on system is developed, further testing will include dimensions such as fun, functionality, and interactivity to comprehensively enhance the press-on nail virtual try-on experience.

Overall, this study offers a fresh perspective on enhancing the virtual try-on experience for press-on nails, expands the application scenarios of virtual try-on platforms, and drives the digital transformation of the press-on nail industry. It also contributes to the academic field by broadening the research scope of virtual try-on technology and providing new insights and theoretical foundations for related academic discussions. As digital technologies such as AR and AI continue to evolve, we believe that AR glasses will become an important shopping medium for consumers, ushering in a new era for the virtual try-on experience of press-on nails.

References

[1] Maganioti, A.E., Chrissanthi, H.D., Charalabos, P.C., Andreas, R.D., George, P.N. and Christos, C.N.(2010). Cointegration of Event-Related Potential (ERP) Signals in Experiments with Different Electromagnetic Field (EMF) Conditions. Health, 2, 400-406.

[2] Li Zhuo(2019). Research on Enterprise Supply chain management Strategy in the New era. Enterprise Technology and Development, (05), 267-268.

[3] Wang, Q. (2024). "Press-on Nails" and the Trillion-Yuan Market. China Brands, 2024(03).

[4] Son, M. Y. (2024). Case Study on AR Technology Use in the Fashion Industry: Focusing on Classification of Use Types. Sensibility Science, 27(1), 81-92.

[5] Alshurideh, M. T., et al. (2024). Examining the Effect of Virtual Reality Technology on Marketing Performance of Fashion Industry in Jordan. International Journal of Data and Network Science, 8(1), 1-6.

[6] Lee, H., Xu, Y., & Porterfield, A. (2021). Consumers' adoption of AR-based virtual fitting rooms: from the perspective of theory of interactive media effects. Journal of Fashion Marketing and Management, 25(1).

[7] Yoo,S., & Kwon, M. J. (2019). A Study on Spatial Aesthetic Characteristics in Modern Fashion Converged with Virtual Reality Technology -Focusing on Fashion Shows, Fashion Exhibitions, and Fashion Design Apps-. Journal of Fashion Business, 23(5).

[8] M. Blázquez, "Fashion shopping in multichannel retail: The role of technology in enhancing the customer experience", Int. J. Electron. Commerce, vol. 18, no. 4, pp. 97-116, Jul. 2014.

[9] J. Kim and S. Forsythe, "Adoption of virtual try-on technology for online apparel shopping", J. Interact. Marketing, vol. 22, no. 2, pp. 45-59, May 2008.

[10] T. Zhang, W. Y. C. Wang, L. Cao and Y. Wang, "The role of virtual try-on technology in online purchase decision from consumers aspect", Internet Res., vol. 29, no. 3, pp. 529-551, Jun. 2019.

[11] Witmer, B. G., & Singer, M. J., 1998. Measuring presence in virtual environments: A presence questionnaire. Presence: Teleoperators and virtual environments, 7(3), 225-240.